

GHP and GMP Manual

Good Manufacturing Practices (GMP) and Good Hygienic Practices (GHP) are part of the prerequisite programs and their implementation prior and during to the application of the HACCP are required to ensure food safety. According to European Directives, Good Manufacturing Practices (GMP) is defined as "part of Quality Assurance which ensures that products are consistently produced and controlled to the quality standards appropriate to their intended use." In addition, regarding to the Code of Federal Regulation (FDA, 2001), GMP involves all basic processes and practices which are considered essential in the production of safe foods. As for the Good Hygienic Practices (GHP), Codex Alimentarius (CAC, 2001) defined it as "all conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain". (FDA, 2001)

GMP and GHP for soy yogurt drink with kiwi flavor are explained in detail as follows:-

1. BUILDINGS AND FACILITIES

1.1 Location

In the determination of the appropriate location numerous factors have to be considered, for instance physical and geographical factors and the availability of infrastructure. Specifically, physical factors include adequate size (for present needs and future developments). In addition, the location has to be selected in such a way in order to be easy access by road, rail or water. An adequate supply of potable water and energy must be available throughout the year. Special considerations must be given to waste disposal. The plant should have proper sanitary sewers. Also solid waste handling have to be considered, and suitable space - away from the plant - must be allocated or be available. Furthermore, evaluation of pollution risk from adjacent areas must also take into account. Contaminants such as smoke, dust, ash, foul odors and bacteria may have to be considered as airborne contaminants. The closely physical surroundings of a yogurt drink factory should be landscaped and present attractive appearance to the visitor but not to rodents and birds. If shrubbery exists it would be at least 10 m away from buildings while grass (if exists) must be free strip covered with a layer of gravel or concrete should follow the outer wall of buildings. Grounds which are in front of doors and entrances should be paved in order to minimize dust. All areas around the plant and facilities should be well drained to prevent any standing water, where flies and microorganisms could breed and develop (Huss, 2003).

1.2 Design and Layout

The basic infrastructure for the production of yogurt drink should be in place. The layout design has to be developed in such a way to prevent criss-cross movement from persons and material. The yogurt drink processing plant should provide (Troller, 1993) enough space for equipment, installations, storage of materials and changing facilities for personnel. Also, adequate lightning, ventilation and protection against pests should be provided. To prevent contamination (from bacteria entered with the raw material) separation of operations and appropriate arrangement of the layout (see Appendix for Design Layout) should be provided i.e raw material entrance and personnel entrance has to be different, raw material reception and storage should be on different rooms, toilets and washing rooms should be away from the production area, flow of discarded outer packaging material should not cross the flow of process. All requisite "No Objection Certificates" from several authorities must be acquired. The external walls, roofs, doors and windows must be water-, insect- and rodent-proof.

1.2.1 *Internal Structures & Fittings*

a) Flooring must be smooth, impervious, with no crevices or damaged. Floors must be constructed to allow adequate drainage. The junctions with walls should be in that way in order to be cleanable (for instance not having sharp angles).

b) Roof should not have any gap while should be water resistant, and constructed in such way so as to minimize build-up of dirt and shedding of particles.

c) Walls and partitions should have a smooth surface and have to ensure that wall paint is not be flaking off. No crevices should exist to support pest growth.

d) Windows and ventilators should be fitted with cleanable insect-proof screens/ louvers where necessary. The glass of windows should be shatter-proof. Mesh on windows (ventilator) should be free from any cuts in order to avoid pest access.

e) Doors must have smooth, non-absorbent surfaces clean and disinfect easily. At the entry and exit points, air curtains, wire mesh, doors with the self-closing devices should be placed.

f) The surfaces that come into direct contact with food have to be free from cracks, crevices, open seams and clean, maintain and disinfect easily. They have to be made of smooth (such as free from sharp internal angles or corners), non-absorbent materials and inert to food, detergents and disinfectants under normal operating conditions.

1.2.2 Water supply

a) An adequate supply of potable water with proper facilities for storage, distribution and temperature or any other controls should be available.

b) Tanks for storing the water should be covered appropriately to prevent animal, bird, pest access preventing in this way water contamination.

c) Non-potable water systems (such as fire control, steam production, refrigeration, sanitary conveniences) should not be connected with potable water systems. Potable water pipes should not be concealed as non-potable water pipes.

1.2.3 Drainage and waste disposal

a) Drainage systems should be appropriately designed and constructed when sewage discharge is complying with the requirements of environmental pollution board. Rainwater pipes should be constructed of impervious rust-proofing materials.

b) Drains in the processing area should be covered and made of impervious rust-proofing material. It is required to have adequate trapping devices to avoid pests' access allowing effective cleaning.

1.2.4 Cleaning

For cleaning the raw materials, ingredients food, utensils and equipment, adequate facilities, suitable designated, should be provided. Adequate supply of hot and cold potable water should also be provided. "Clean" (areas where any contaminant added to the product) and "unclean" (areas where raw material is handled) areas should be physically separated (e.g by wall). Also, cooled rooms must be separated from hot rooms where heating etc. are taking place. Dry rooms must be separated from wet rooms and separate rooms must be provided for waste material, chemicals (cleaning and disinfection compounds, insecticides, all toxic materials), packaging materials. Equipment and utensils used in the unclean areas should never be used in the dean area. It has to be ensured that there are no interruptions and no "dead ends" in the product flow, where semi- processed material can accumulate and remain for a long time at ambient temperature. The CIP process should be used for cleaning the process lines by performing sanitation and sterilization operations. After CIP application, removal of residues (milk, yoghurt and other additives) which can provide nutrients for micro-organisms if remain on the surfaces of equipment, should be ensured. Also, removal of residual cleaning compounds which may contaminate the yoghurt should ensure.

Processing equipment, including the pipelines, is properly emptied from yoghurt residues before commencing the cleaning programme (Robinson 1999).

1.2.5 Air quality and ventilation

a) Adequate ventilation (natural or mechanical) should be provided for minimizing air borne contamination, controlling ambient temperatures and humidity.

- b) Food processing areas where operations result in release of steam (such as pasteurizers, packaging machine) should have an exhaust system or ventilation.
- c) It should be ensured that air does not flow from unclean to clean areas.

1.2.6 Lighting

- a) Natural or artificial lighting should be provided in all food locations without resulting to a misleading colour.
- b) Lighting should be protected in order to prevent any accident with broken glass (Troller, 1993).

1.2.7 Power Back up

Uninterrupted supply by the use of generators, invertors should be provided to guarantee that production process would not be interrupted.

1.2.8 Pest control

A control program should be highly effective to ensure there are no signs of pest infestation which includes flies, cockroaches etc. The pest control activities should be performed by trained personnel and pest control chemicals should not contaminate the food product.

1.3 Temperature control (product area)

- a) Food temperatures have to be monitored in operations which require heating, cooling, refrigerating and freezing food and storing refrigerated.
- b) Ambient temperatures should be controlled to ensure the safety and suitability of food.

1.4 Storage

Adequate facilities for storage of food, ingredients, packaging material and non food chemicals should be provided. Receiving of raw material area and storage room should be close (see Appendix for Design Layout).

1.5 Personnel hygiene facilities and toilets

- a) Adequate means of hygienically washing and drying hands including wash basins and supply of adequate water of potable quality should be provided. Taps must not be hand operated.
- b) Hand wash basins and sanitizers should be situated in such places in order to allow hand washing before starting of operations.
- c) Toilets of appropriate hygienic design, should be suitably located, having adequate natural or mechanical ventilation and natural or artificial lighting.
- d) Adequate changing facilities for personnel should be provided.

2. Personnel

Person suffering from chronic gastrointestinal and respiratory tract diseases, short-term conditions such as colds, acute diarrhoea, skin rashes, boils, open superficial injuries and peeling sunburn should avoid contact with processing area. Operators should be required to report any such conditions, and supervisory staff should be on the look-out for them. There should be periodic health checks. No person who reports that they have a condition that would preclude their working in a clean area should suffer any penalty for doing so. The thought of loss of earnings might well persuade even the most virtuous worker to keep quiet about an adverse health condition. Any outside persons such as visitors, who have not received the training and who need to enter factory, should only do so under close supervision and when wearing protective clothing appropriate to the area. The first key aspect of training that must be addressed is ensuring that the staff has an appropriate knowledge of GMP (Edy). Personnel should enter a clean area via changing rooms, where washing and changing should proceed in strict accordance with a written

procedure. The operators should have been trained to follow this procedure, and a copy of it clearly displayed on the changing room wall. The procedure should be designed to minimise contamination of the protective clothing through, for example, contact with the floor on the “dirtier side” or with operators’ shoes. Outdoor clothing and shoes should not be taken into clean processing area. Personnel should clad in the standard “general factory” protective clothing.

Wristwatches, jewellery should be removed as part of changing process. Cosmetics, other than perhaps simple particle-free non-shedding creams, should not be worn. Head should be properly covered in order to avoid contamination of the product with hair. The protective garments should be comfortable to wear and loose-fitting to reduce abrasion (Sharp 1983). Chewing gum, smoking, eating and alcohol should be strictly prohibited in processing area. Personnel should wear protective gloves wherever necessary in processing area. Nails should be properly trimmed and without any nail varnishes. There should be written instructions and signs of personnel hygiene which could be given as follows:

- ✓ Keep body, hair, face, hands and fingernails clean.
- ✓ Report any illnesses, cuts, grazes or respiratory, gut or skin problems.
- ✓ Follow the written changing and wash-up procedure exactly.
- ✓ Check that your protective clothing is worn properly.
- ✓ Do not wear cosmetics, jewellery or wristwatches.
- ✓ Leave all personal items (wallets, coins, keys, watches, tissues, combs, etc.) in the changing room.
- ✓ Do not take papers, documents or paper materials into clean rooms, unless these have been specifically approved.
- ✓ No eating, chewing or drinking.
- ✓ Always move gently and steadily.
- ✓ Do not move vigorously. No playing about, singing or whistling.
- ✓ Avoid talking unless absolutely necessary.
- ✓ Avoid coughing or sneezing. If these are unavoidable, leave the processing area.
- ✓ Do not touch other operators.
- ✓ Avoid scratching, touching nose and mouth and rubbing hands.
- ✓ Where gloves are worn, regularly disinfect them as instructed.
- ✓ Always check for worn or damaged garments and torn gloves and change them as necessary.
- ✓ Keep garments fully fastened up. Do not unfasten or loosen them.
- ✓ Unless there is a special hazard involved, do not pick up dropped items from the floor (Sharp 1983).

3. Production and Process Control

3.1 Receiving of raw material

Raw cow’s milk, soy milk, sugar and kiwis should be received from guaranteed supplier. Milking of cows in clean environment gives good quality milk with the minimum microbial content. Good quality soybeans free from mould or pests should be used by supplier for soy milk production. It should be free from beany flavour. Feed to cows should be free from pesticides in order to avoid the traces of contaminants in milk. When all raw materials are received at receiving point, the adequate records such as date of purchase, name of supplier, quantity of material should be maintained. These records help to limit product recall and product liability in the events of outbreak.

Maintenance of hygienic conditions during transport of material from supplier to company is important. Sanitation of tanks or tankers carrying milk is important aspect. All microbial (Statistical plate count, total microbial count) and chemical (pesticide residues, antibiotic, mycotoxins) parameters of cows milk (Chandan 2008) and soy milk needs to be checked at the receiving point and it should meet with standards set by the company. Parameters (colour, impurities) for sugar should also be analysed and sugar should be hygroscopic. Bags used for sugars needs to clean. If the bags containing sugar are torn or busted it should be rejected because it can cause contamination of the product and also other sugar bags in the storage room. ICCUMSA (International commission of uniform methods of sugar analysis) standards are mainly set for the colour of sugar. Water coming from any source (wells, dam) should

be treated well in water treatment plant with the various systems such as sand filters, reverse osmosis, uv rays etc to remove the impurities. Parameters of water like hardness, pH, alkalinity, dissolved oxygen needs to be checked before using for further processing in order to ensure the safety. Excessively damaged and over ripened kiwi should be rejected before unloading the whole truck at receiving point. There should not be traces of insects and animal filth on the kiwi fruits.

Proper sampling and labelling the samples of the milk for chemical and microbiological analysis with hygienic conditions is important. There should be control of the temperature during intake of the milk from the supplier. Proper cleaning chemicals for cleaning and disinfection of the premises, equipments should be selected. There should be introduction of procedures for cleaning and disinfection of the premises and equipment at the collecting centre. Instruments used for chemical and microbiological analysis should be calibrated

3.2 Storage of raw material

Cow's milk and soy milk must be stored at 4°C. Milks are then need to be stored in silos with mechanical propeller for agitation in order to avoid fat separation which but be gentle (Chandan 2008). Sugar must be stored in cool, dry and low humid place. Kiwis are stored in controlled atmosphere with maintained temperature, humidity, oxygen level so kiwis will not over ripened even if stored for longer time. Storage tanks of milk should be sanitized and cleaned. Tanks should be properly dosed.

The inside of the tanker is washed by a cleaning in place system after unloading milk into company with detergents followed by sanitizer. Storage tanks or silos of milk should be sanitized and cleaned at least every 72 hr 2008). Visual inspection of the interior surface could be done if any construction or repair defects are there. Storage tanks should be properly closed (Chandan, 2008).

3.3 Pasteurization

Time (30min) and temperature (62.8°C) are the most important conditions which need to be maintained during pasteurisation. Alkaline phosphates test needs to be conduct after pasteurization to check effectiveness of this process. Results of this test should be negative which will show that pasteurization has destroyed alkaline phosphatase enzyme and worked effectively. Pasteurization can be made more effective with: i) an automatic temperature control, ii) a recording thermometer, iii) an automatic safety device preventing insufficient heating iv) an adequate safety system preventing the mixture of heat-treated drinking milk with milk which has not been fully heat-treated. Pasteurisation must include a means of controlling the product flow rate to ensure that the minimum specified holding time is maintained at all times. The flow rate and the heating system of the pasteurizer must be periodically checked and calibrated according to the manufacturers standards. For maintaining good hygiene practices for pasteurization, a constant supply of good hygienic quality water should be available in ample quantity. Adequate supply of fuel for steam that is required for heating the milk in the pasteurizer and also proper supply of electric current. Pasteurizer should be sanitized, disinfected and cleaned with water after every lot of milk passes through it, therefore the pasteurizer should be so designed in way so that it can be easily dismantled and reassembled.

3.4 Homogenization

The pressure during homogenization of soy milk and cows milk should be maintained at 20 to 140 MPa and the droplet size should be 1µm to 3 µm. According to the industrial procedure the temperature of the milk should be 40 to 65 ° C so that the milk is properly homogenized. Excess temperature and pressure affect the quality of milk

For homogenization of final product the pressure of the homogenizer should be maintained at 6 MPa. Maintenance of homogenizer must be carried out periodically. Homogenizer used for this procedure must be properly cleaned, sanitized after each batch. Separate homogenizer must be used for the cows milk, soy milk and final product. There should not be traces of detergent or sanitizer in homogenizer.

3.5 Standardization

- The raw cows milk received should be standardized and checked for the percentage of fat which is important for fat content of final product as our product is low fat. SNF needs to be measured as it is going to affect on texture of yoghurt. The fat content of the raw milk should not be less than 2% and must not be more than 4% so as to make the standardization easy and quick. Standardization of raw milk must not be initiated unless the results of the initial testing of the raw milk are satisfactory.

- Kiwi juice should also be standardized to check its acidity to 0.146%, pH to 3.55 and total solids to 13%. Standardization of kiwi juice is necessary to do. All the parameters of kiwi juice should be within standards set by company otherwise it's going to affect the final quality of product.

Proper hygiene and sanitation of the separator used for standardization must be maintained. Separator must be cleaned with proper disinfectant and clean water after every lot of milk.

3.6 Inoculation with bacterial culture

Adequate amount of bacterial culture (0.1%) needs to be added in milk to get desired acidity level. The supplier of culture should have government certification to produce cultures. Bacterial culture should be stored at -12° C (Ertola 1965). Bacterial culture handling and inoculation should be performed only by microbiologist and no other person. There should not be any direct contact with person responsible for addition of culture to milk. Assure that bacterial culture do not contain any bacteria other than desired ones. Care should be taken that cultures are prepared in aseptic conditions and transferred in same way.

3.7 Fermentation

Fermentation must be carried out in fermentation tanks only. Ideal Temperature should be maintained at 40 to 45 ° C for the growth of micro organisms. Acidity of the yoghurt should be checked at regular intervals to confirm the desired acidity level. Acidity depends on amount of culture, temperature and time of fermentation which is between 4 to 5 hours; therefore it is a good manufacturing practice to check if culture for yoghurt preparation is added in quantity as per the standards with maintained temperature and time. Temperature measuring probes should be checked for any faulty readings.

The fermentation tanks should be always properly sanitized after every batch of fermentation. After cleaning it should be confirmed that there is no accumulated product at the edges or at the outlet of the tanks. Traces of sanitizers and disinfectants should not be found after cleaning. The tanks should always be covered so that the temperature won't change and there won't be chance of accidental addition of unnecessary foreign material.

3.8 Sorting of kiwis

Damaged, over ripened or under ripened fruits if found should be removed. Stem ends of the kiwis must be removed as it may damage the fruit. Very small kiwis should be removed as their chemical composition might not be as same as average ones.

Personnel performing sorting task should wear gloves as kiwi fruit has thorn like skin which might affect on skin due to frequent handling. And also proper uniform should be worn by the personnel sorting kiwis.

3.9 Washing of kiwis

Washing is one of the most important processing step and good manufacturing practice. The kiwi fruits should be washed in water containing KMNO_4 . Levels of KMNO_4 should be always maintained at 0.1%. Water used should be changed after every hour or else traces of dirt, dust/mud would be found on the fruits even after washing which may

contaminate product in further steps of processing. Cleaning of washing tank should be carried out after every batch to remove all the accumulated dirt, dust/mud in the corners or the edges, etc; which is good hygiene practice.

3.10 Chilling

Chilling temperature should be maintained at -18°C for 30 minutes to facilitate peeling and also to reduce the loss of flesh with skin. It also avoids the breakage of seeds during extraction of juice. If the time of chilling is more than 30 minutes may cause chilling injury to the fruit. To maintain and provide appropriate chilling to all the fruits stored in the chillers the speed of the blowers should be adjusted accordingly. Chilling premises must be always clean. The fruits should be properly placed in boxes and palletized so that there won't be any damage to fruits if an accident takes place.

3.11 Peeling

Peeling is done in automated peeler with 30 fruits per minute capacity. If the machine gets clogged with the peels it should be stopped immediately by the operator and cleaned. Inspection of the fruits should be done to ensure that all the peel is removed from the fruit by a person. Hard part at middle needs to be removed to make extraction more effective. Then kiwis are cut into small pieces. The person inspecting the fruits should wear disinfected gloves to handle the fruits and also must wear a head covering. Peeler should be cleaned with water and disinfected at regular intervals.

3.12 Extraction of juice

Kiwi fruit is passed through fruit press to get juice. During the application of pressure to extract juice it should be checked that all the fruits are properly pressed and complete juice is extracted. The pressure application equipment should be periodically checked for any faults and especially for leakage of oil as it may contaminate the juice. The operator and the production in charge will be responsible for the proper operation of the machine.

The pomace left on the screen of the press must be cleaned at regular intervals to avoid the choking of the screen and if not cleaned after every batch, microbial growth can take place. The person working at this step should wear all protective clothing and coverings to avoid any type of contamination of juice. Sanitization and disinfection of the fruit press should be done after every batch.

3.13 Coarse filtering

Filtering of juice is necessary to remove any uncrushed fruit pieces, fine and colloidal particles. To make the uniform filtration of final product is an important step, therefore it is necessary to check whether the juice is properly filtered or not. A person must be appointed to always check the filtration process is working efficiently. Filtrate should be removed after every batch to prevent blocking and microbial growth.

The filters must be cleaned, sanitized after every batch. Person inspecting this process should be with protective clothing, head covering and hand gloves as well.

3.14 Mixing kiwi juice with water

Filtered juice should be mixed with treated water only. Water is mainly added to get desired thickness of final product. Soft water is used for this purpose so incoming water to industry should be treated to remove all impurities. Parameters of water such as hardness, pH, alkalinity need to be checked with the interval of 3 hr of incoming water. All filters, tanks used for water treatment should be sanitized, cleaned with regular interval. Regular inspection of tanks, filters is needed in order to prevent clogging of inlet and outlet due to the presence of salts. Mixing tank of kiwi juice and water should be sanitized with detergent after each batch. Tanks should be properly rinsed to avoid the contamination of the product with sanitizers.

3.15 Mixing of all ingredients

Specified amounts of cow's yoghurt, soy yoghurt, kiwi juice and sugar are added together. All the instruments used to measure these ingredients should be accurate and must be calibrated timely. Blending is done in the mixing tanks with the help of stirrer at constant speed for 15 minutes. Blending should not be done vigorously and for longer than 15 minutes as it may break the seeds. Sugar must be added continuously and slowly so that there won't be formation lumps and settling of sugar at the bottom. Stabilizer and acidity regulator should be added according to the legislation i.e 0.01 to 0.5% & 0.8% respectively. Both should be added in the same way as of the sugar. CIP system could be used for the sanitation and hygiene of the tanks. CIP system should be highly efficient to clean all the parts of tank like stirrer, inlet and out let. The person adding the dry ingredients such as sugar, stabilizer and acidity regulator should wear head covering, hand gloves, protective clothing.

3.16 Deaeration

Deaeration of the product is an important part of yogurt drink production process. Contact with air should be avoided as it causes oxidation of the product which alters changes in quality and safety. So, once all ingredients are mixed it should be immediately transferred to the deaerator tanks. Deaeration system should be periodically checked and maintained. This process should be monitored constantly by an operator and must try to maintain the desired pressure continuously. After deaeration, the final product is proceeded for further treatment but it should not be exposed to air. The deaerator with ability to show defective vacuum creation should be used to create vacuum in bottles.

The deaerator tanks should be always inspected for cleanliness before filling it with all mixed ingredient and should be cleaned with disinfectants, sanitizers and then with clean water to ensure complete cleaning of the tanks.

3.17 Filling and sealing

PET bottles and lids used must be clean, free from dirt, dust and washed properly with hot water. Head space should be maintained uniformly in all the bottles which can inspected by the person at the filling point. Deaeration of the bottles need to be carried out after filling. After creating vacuum, bottles should be properly sealed with the lids. PET bottles should be with proper label which includes name of ingredients, date of manufacturing, name of manufacturer, used by, nutritional content etc.

Bottles should be cleaned properly with detergents followed by hot water. Traces of detergents should not remain in bottles. Filler heads should be clean and washed after every batch to avoid microbial growth at the heads. Hygiene needs to be maintained at the sealers as well.

3.18 Package, storage and distribution

PET bottles used should be opaque in order to avoid physicochemical changes due to light on product. Aluminium foil could be used to seal head to make packaging more effective. Sealed bottles are then kept in cartons and then palletized. There should be some specification for the number of PET bottles in one carton. There should be specific information (number of bottles, name of manufacturer legal definition of yogurt drink) on cartons as per the legislation. Packaged product should be stored at 4°C in cold room. Temperature should be properly maintained. Number and thickness of cartons, spacing within two pallets should be specified. Cartons should not be stacked to very high level. There should not be any damage to the product during transportation. During the transportation temperature maintenance (4°C) is important aspect. Controlled atmosphere system could be used. All packaging material should be stored in clean, dry place. Vehides used for transportation should be clean and maintained.

4. Equipment

The equipment should be designed and constructed in such a manner to reduce physical damage to the raw materials and product e.g. by ensuring there are no sharp inside corners or projections and that physical, chemical or biological hazards are not introduced into the product.

The basic hygienic principles for equipment design agreed upon by a working party appointed by the Food Manufacturers Federation (FMF) and Food Machinery Association FMA (FMF/FMA, 1967) and that they should follow are the following:

- All surfaces in contact with food must be inert to the food under the conditions of use and must not migrate to or be absorbed by the food
- all surfaces in contact with food must be smooth and non-porous so that tiny particles of food, bacteria, or insect eggs are not caught in microscopic surface crevices and become difficult to dislodge thus becoming a potential source of contamination
- all surfaces in contact with the food must be visible for inspection or the equipment must be readily disassembled for inspection, or it must be demonstrated that routine cleaning procedures eliminate possibility of contamination from bacteria or insects
- clean-in-place techniques must be demonstrated that the results achieved without disassembly are the equivalent of those obtained with disassembly and manual cleaning
- all interior surfaces in contact with food must be so arranged that the equipment is self emptying or self draining
- equipment must be so designed as to protect the contents from external contamination
- the exterior or non-product contact surfaces should be arranged to prevent harbouring of soils, bacteria or pests in and on the equipment itself as well as in its contact with other equipment, floors, walls or hanging supports.

Equipment should be constructed in such way so as dead areas and dead ends should be avoided (food can be trapped and bacterial growth takes place) following the "first in first out" principle.

Machinery safety and hygiene regulations according EC (1992) include the following:

- machinery containing materials intended to come in contact with food must be designed and constructed so that these materials can be cleaned before each use
- all surfaces and their joinings must be smooth, with no ridges or crevices that could harbour organic materials
- assemblies must be designed to minimise projections, edges and recesses
- contact surfaces must be readily cleaned and disinfected, and built with easily dismantled parts. Inside surfaces must be curved in a way to allow thorough cleaning
- liquid derived from foods, as well as cleaning, disinfecting and rinsing fluids should be readily discharged from machinery
- machinery must be designed and constructed to prevent liquids or living creatures - primarily insects - from entering and accumulating in areas that cannot be cleaned
- machinery must be designed and constructed so that ancillary substances, such as lubricants, do not come in contact with food.

- Milking equipment should be designed, constructed, installed, maintained and used in a manner that will avoid the introduction of contaminants into milk. It should be operated in a manner that will avoid damage to udder and teats and that will avoid the transfer of disease between animals through the milking equipment.

- Milk transport tankers, milk storage tanks and cans should be designed, constructed, maintained and used in a manner that will avoid the introduction of contaminants into milk and minimize the growth of micro-organisms in milk.

- Fermentation tanks are only insulated in order to maintain an even temperature during the incubation period. The agitation system in such tanks is optional, since the cone-shaped base facilitates easy removal of the coagulum.

- The throughput/unit time of plate or tubular cooler should be roughly double the capacity of the processing plant, so that if the plant capacity ranges from 3500 to 4000l hour⁻¹, then the capacity of the cooler should be in the region of 8000l hour⁻¹.

- Freezers should be designed and constructed so that, when properly operated, they meet the requirements of a quick freezing process.
- The entire filling machine should be cleaned by CIP (i.e. circulation rate 30m³ hour⁻¹ at 0.3 MPa pressure) and the filling head can be steam sterilised at 143°C. Also, the machine should be fitted with a cup leakage sensor to ensure proper closure of the containers.
- Records should be kept, as necessary, to enhance the ability to verify the effectiveness of the control systems.

5. Training

All the managers and supervisors should have enough knowledge about the HACCP, GMP, GHP. The employees working on all the processing lines should be enable to have the require knowledge and skills for the task to be performed by them to give safe and hygienic yogurt drink. The training should be held at least on the six months by the expertise of dairy and juice industry. The personnel working in industry should be highly effective in his work so that the management can rely on him for the safety of the product.

6. Documentation

The fact that a process or product is being developed does not reduce the need for documentation.¹ There need to be a full documentation of records of following:

raw material and packaging purchasing (date, quantity unloaded, name of supplier, approval from purchasing and quality manager), processing operation (batch records, name of operator, number of units produced, quantity of raw material used), results of the analysis (water, sugar), employee (name, post), management(marketing), HACCP, manufacturing methods of cow's yogurt, soy yogurt and kiwi juice and final drink, in process testing (e.g pH, temperature during fermentation), copy of label approved by management and in compliance with legislation, storage (temperature of final product) and shipping conditions .

This is often done by the use of pre-designed and authorised forms, such as the master-batch manufacturing record and forms used to collect analytical data. Laboratory records of analysis must be maintained. Entries in the documents should be direct, immediate, legible and permanent; entries should be signed and dated. Specification of raw material such as microbial and chemical content of milk; hardness, pH, alkalinity of water; colour of sugar and of final product (TSS, pH, acidity) should be maintained. Specification records are of only value if it is up to date.¹ Quantity of product, date of distribution, name of distributor should be noted.

7. Product recall and traceability

When there are any physical, chemical or microbiological changes in the yogurt drink during the storage on the retailer's shelf, then the yogurt drink needs to be recalled since it could affect the safety of the consumer. The recalled products should be kept under the observation until they are destroyed, used for the purpose other than human consumption or analysed to find out the reasons behind the problem. Moreover, the recalls of the recalled product should be maintained. Food establishments should, as far as possible, and appropriate, maintain an effective mechanism for identification and traceability of incoming material to the supplier and delivery of finished food product to the customer.

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